LAKE OF THE WOODS

Marshall County

2008 and 2009 Walleye Evaluations

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EXECUTIVE SUMMARY

- Lake of the Woods is a 416-acre natural lake located approximately five miles southwest of Bremen, Indiana in northern Marshall County.

- The Indiana Division of Fish and Wildlife (DFW) maintains a public access site at the southwest shoreline.

- The DFW has been stocking walleye since 1990, and in 1996, a 14.0-inch minimum length limit was established.

- The last fisheries survey of Lake of the Woods was conducted in 2007 and revealed that the fishery had shifted from being dominated by rough fish such as carp, shad, gar, and suckers in 1996, to be being dominated by sport fish (walleye, white bass, bluegill, channel catfish, and yellow perch) (Long 2008).

- The Lake of the Woods fishery has become dominated by predator species resulting in a reduction of prey populations. Therefore in 2008, the annual stocking rate of walleye fingerlings was reduced from 100 /ac to 50 /ac (20,800 total).

- A walleye evaluation was conducted on September 23 and 24, 2008. Fish were collected using two sampling gears. Pulsed DC night, shoreline electrofishing was conducted for 1.0 h with two dippers and five gillnets were also fished overnight. The 2009 evaluation was conducted between September 24 and September 30, 2009. Pulsed DC night electrofishing was conducted for 4.0 h. No gillnets were set in 2009.

- A total of 71 walleye, weighing 42.2 lbs, was collected during the 2008 fall evaluation. The catch per unit effort (CPUE) of walleye was 5.2 /standard gill net lift and electrofishing yielded a CPUE of 45.0 f/h. Walleye ranged in length from 4.5 to 19.0 in and averaged 12.9 in. Three age-0 walleye were collected in 1.0 h of electrofishing (3.0 f/h).

- In 2009, 238 walleye weighing a total of 59.2 lbs was collected. The electrofishing CPUE of walleye was 59.5 f/h. Walleye ranged in length from 5.6 to 21.0 in and averaged 9.4 in. The CPUE for age-0 walleye was 42.8 /h, which accounted for 72% of the sample.

- The differences observed in walleye CPUE's between years can be attributed to the amount of sampling effort and the gear used during the 2008 and 2009 evaluations.

- It is recommended that all future evaluations be conducted biennially beginning in 2011 and consist of a total of 4.0 h of night DC electrofishing divided into two nights.

- The DFW should continue annual walleye stockings at Lake of the Woods at the rate of 50 fingerlings per acre.

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INTRODUCTION

Lake of the Woods is a 416-acre natural lake located approximately five miles southwest of Bremen, Indiana in northern Marshall County. The Indiana Division of Fish and Wildlife (DFW) maintains a public access site at the southwest shoreline. The DFW has been stocking walleye since 1990, and in 1996, a 14.0-inch minimum length limit was established (Table 1).

The last fisheries survey of Lake of the Woods was conducted in 2007 and evaluated the fish community at Lake of the Woods under work plan 300FW1F10D40621. The survey revealed that the fishery had shifted from being dominated by rough fish such as carp, shad, gar, and suckers in 1996, to be being dominated by sport fish (walleye, white bass, bluegill, channel catfish, and yellow perch) (Long 2008).

Walleye abundance increased between 1996 and 2007 from 3 to 34%, respectively. This was not surprising since the stocking rate of walleye fingerlings was increased from around 65/ac to 100/ac between 1999 and 2000 (Table 1). Overall, the Lake of the Woods fishery has become dominated by predator species resulting in a reduction of prey populations. This has contributed to below average walleye growth and created an imbalance between predator and prey populations. Therefore in 2008, the annual stocking rate of walleye fingerlings was reduced from 100/ac to 50/ac (20,800 total). The decreased walleye stocking rate should help alleviate predation on prey populations allowing them to rebound over time. The change in stocking rate, as well as the previously reported below average growth, prompted further evaluation of the walleye stocking program in 2008 and 2009.

The goal of the 2008 and 2009 walleye evaluations at Lake of the Woods under the statewide percid work plan 300FW1F10D42617 were to assess age-0 catch rates (CPUE) and overall walleye growth.

METHODS

A walleye evaluation was conducted on September 23 and 24, 2008. Fish were collected using two sampling gears. Pulsed DC night, shoreline electrofishing was conducted for 1.0 h with two dippers and five gillnets were also fished overnight.

The 2009 evaluation was conducted between September 24 and September 30, 2009. Pulsed DC night electrofishing was conducted for 4.0 h. No gillnets were set in 2009.

All walleye collected were measured to the nearest 0.1 in total length (TL) and separated into half-inch groups (X.0-X.4 for inch group and X.5-X.9 for half-inch group). Walleye

collected during the electrofishing sample were weighed nearest 0.01 lb. Weights were not taken from fish collected from the 2008 gillnet sample. Five otolith samples were taken per half-inch group for age and growth analysis each year. Two readers were used to age the otolith samples.

RESULTS

A total of 71 walleye, weighing 42.2 lbs, was collected during the 2008 fall evaluation. Walleye ranged in length from 4.5 to 19.0 in and averaged 12.9 in. The catch per unit effort (CPUE) of walleye was 5.2 /standard gill net lift and electrofishing yielded a CPUE of 45.0 f/h (Table 2). The two gear types were similar in their catches of walleye greater than 14 inches while electrofishing was far more effective for fish less than 14 inches (Table 3). Three age-0 walleye were collected in 1.0 h of electrofishing (3.0 f/h). Seventeen percent of the walleye collected were age 1. Age-2 and age-3 walleye comprised 28 and 34%, respectively, of the walleye collected. Thirteen percent of the walleye collected were age 4 and 4% (3 walleye) were age 5. Forty-one percent of walleye exceeded the 14.0 in minimum length limit.

In 2009, 238 walleye weighing a total of 59.2 lbs was collected. The electrofishing CPUE of walleye was 59.5 f/h (Table 2). Walleye ranged in length from 5.6 to 21.0 in and averaged 9.4 in. The CPUE for age-0 walleye was 42.8 /h, which accounted for 72% of the sample. Not surprisingly age-1 walleye comprised only 4% of the walleye sample and averaged 11.3 in TL. Eleven percent of the walleye collected were age 2 and averaged 13.2 in TL. Age-3 walleye averaged 14.3 in TL and made up 11% of the sample. Walleye ages 4 and 5 averaged 16.2 and 16.9 in TL, respectively. A single age-6 walleye was collected and measured 21.3 in TL. Overall, 14% of the walleye collected exceeded the 14.0 in minimum length limit.

DISCUSSION

The walleye fishery at Lake of the Woods has become extremely popular. In 2007 a creel survey determined that 41% of fishermen targeted walleye (Long 2008). The catch rate of walleye by anglers (harvested + caught and released) was 1.1 /h which totaled almost 6,000 fish during the survey. The high catch rate (walleye/h) by anglers was reflective of the relative abundance of walleye (34%) collected during the 2007 fisheries survey (Long 2008).

Predator and prey populations have become unbalanced at Lake of the Woods partly because of the introduction of white bass in the mid 1990's (Long 2008). Additionally, the

fishery has shifted from being dominated by rough fish such as carp, shad, gar, and suckers in 1996, to be being dominated by sport fish by 2007 (walleye, white bass, bluegill, channel catfish, and yellow perch). In order to alleviate competition between top level predators, it was recommended to reduce the walleye stocking rate from 100 fingerlings /ac to 50 /ac. After much consideration, this was determined to be the most effective way to manipulate the predator population and allow prey populations to recover (Long 2008).

The DFW, through stocking, has established quality walleye fishing opportunities since the 1970's. Extensive evaluation of Indiana's walleye fisheries was completed in 1987 (Andrews, et al. 1987). This evaluation produced the recommendation that future walleye stocking success or failure would be based on the CPUE of 7.0 age-0 walleye per hour of electrofishing.

Sampling data from 2008 at Lake of the Woods suggested that the first walleye stocking at 50 fingerlings /ac was unsuccessful with a age-0 CPUE of only 3.0 /h (Table 2), although only 1 hr of electrofishing was conducted and random sampling variation could partially explain the low CPUE. Additionally, the small size of age-0 walleye collected in the fall of 2008 may indicate unusually poor growing conditions during the 2008 season. Whether the cause of this was low forage availability or some other stressor, high levels of age-0 mortality are likely to be the root cause of the low catch rates. Shipman (1991) reported that comparisons of fall age-0 walleye CPUE to CPUE the next fall for the same year class revealed a positive relationship. In 2009, age-1 walleye CPUE was 3.8 /h, higher than CPUE as age-0 and approaching the 4.2 yearling CPUE success threshold. While this sampling indicates that the 2008 year class may have been underrepresented in the 2008 sample, the CPUE of this year class at age 1 is substantially lower than the average (11 fish /h) of the previous 4 evaluations (Table 4). Thus the long term outlook on contributions of the 2008 year class to the walleye fishery has improved, however remains marginal at best.

Walleye fingerlings were also stocked at the rate of 50 /ac in 2009. Collection data from 2009 yielded an age-0 walleye CPUE of 42.8 /h. Without question, the 2009 walleye stocking at 50 /ac was successful. Further, sampling with only electrofishing in 2009 continued to document the abundance of older walleye in the population.

With only two years of evaluation data available following the reduction of the stocking rate from 100 fingerlings / ac to 50 / ac, full evaluation of the new stocking rate would be premature. Very little, if any, change has occurred in the abundance of legal-size walleye since

the change (Table 5). While the size of the age-0 walleyes collected was similar to that measured prior to the implementation of the reduced stocking rate, the change will ultimately be judged based on the growth of older fish and catch rates of fish that are legal-sized and larger.

Based on the comparison of the 2008 catches from electrofishing and gill netting, no further gill netting should be conducted as part of fall walleye evaluations at Lake of the Woods as electrofishing proved to be an equally effective method for collecting all sizes of walleye there. Additionally, electrofishing is less labor intensive and reduces unnecessary mortality to walleye and other species susceptible to gill net capture. Electrofishing effort should remain at 4.0 h across two nights to ensure adequate sample sizes for evaluation of growth and to prevent bias due to sampling conditions and locations.

RECOMMENDATIONS

- Conduct biennial fall walleye evaluations utilizing 4.0 h of pulsed DC night electrofishing over two nights.
- Continue the annual stocking of walleye at the rate of 50 fingerlings /ac.

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Table 1. Walleye stocking history at Lake of the Woods, Marshall County, Indiana; 1990–2009.

Year	Number	Size (in)
1990	78,900	1.7
1992	1.3 million	Fry
1993	27,500	1.8
1994	26,750	1.6
1995	27,720	1.8
1996	27,175	1.4
1997	27,348	1.6
1998	27,294	1.5
1999	27,300	1.4
2000	41,604	1.8
2001	42,284	1.3-2.0
2002	41,600	1.3-1.8
2003	41,600	1.8-2.0
2004	43,863	1.3-1.9
2005	39,831	1.4-1.8
2006	41,521	1.4-1.7
2007	41,600	1.3-1.7
2008	18,070	1.2-2.3
2009	21,238	1.5-1.9

Table 2. Catch rate and sampling effort data for 2008 and 2009 walleye evaluations at Lake of the Woods, Marshall County, Indiana. Catch per unit effort (CPUE); young-of-the-year (YOY); electrofishing (EF); gillnet (GN).

	2008	2009
YOY CPUE	3.0 /h	42.8 /h
EF CPUE	45.0 /h	59.5 /h
GN CPUE	5.2 /lift	

Sampling effort	2008	2009
EF (hours)	1.0	4.0
GN (lifts)	5	

Table 3. Comparison of gear type from the 2008 fall walleye evaluation at Lake of the Woods.

		Total catch			
Gear Type	Effort	< 14 in	14 to 17.5 in	≥ 18 in	Overall
Electrofishing	1 hour	32	15	1	48
Gill Netting	5 lifts	13	13	0	26

Table 4. Lake of the Woods walleye stockings since 2000 and cohort statistics from subsequent electrofishing evaluations. The target stocking rate for shaded cohorts was 50 fingerlings per acre.

Date	Number	Mean Length	Age 0		Age 1		Age 2	
Stocked	stocked	at Stocking	CPUE	Mean Lc	CPUE	Mean Lc	CPUE	Mean Lc
6/7/2000	41,604	1.80	-	-	-	-	-	-
5/25/2001	42,284	1.61	-	-	-	-	4	14.1
6/5-7/2002	41,600	1.52	-	-	5	11.5	5	14.3
6/4/2003	41,600	2.00	62	6.3	16	11.1	8	14.1
5/27/2004	43,863	1.56	34	7.3	12	11.1	-	-
6/2/2005	39,831	1.56	53	7.9	-	-	-	-
6/1/2006	41,521	1.56	-	-	-	-	12	12.1
5/24/2007	41,600	1.46	-	-	11	9.5	10	13.2
6/6/2008	18,070	1.54	3	5.1	3.8	11.3	-	-
6/5/2009	21,238	1.70	42.75	7.6	-	-	-	-

Table 5. Fall electrofishing catch rates (Fish / hour) by size from current and recent walleye evaluations at Lake of the Woods.

		CPUE			
Year	Effort (h)	< 14 in	14 to 17.5 in	≥ 18 in	Overall
2003	1.0	69	3	0	72
2004	1.0	52	9	3	64
2005	1.0	69	8	1	78
2008	1.0	29	15	1	45
2009	4.0	51	8	0.5	59.5

APPENDIX I

NUMBER, PERCENTAGE, WEIGHT, AND AGE OF Walleye (September 2008)									
TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AVERAGE WEIGHT (pounds)	AGE OF FISH	TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AVERAGE WEIGHT (pounds)	AGE OF FISH
1.0					19.0	1		2.00	5
1.5					19.5				
2.0					20.0				
2.5					20.5				
3.0					21.0				
3.5					21.5				
4.0					22.0				
4.5	2	2.8	0.02	YOY	22.5				
5.0					23.0				
5.5	1	1.4	0.03	YOY	23.5				
6.0					24.0				
6.5					24.5				
7.0					25.0				
7.5					25.5				
8.0					26.0				
8.5	1	1.4	0.16	1	TOTAL	71			
9.0	5	7.0	0.20	1					
9.5	3	4.2	0.25	1					
10.0	4	5.6	0.31	1, 2					
10.5									
11.0	2	2.8	0.41	2					
11.5	7	9.9	0.41	2					
12.0	4	5.6	0.38	2					
12.5	2	2.8	not weighed	3					
13.0	7	9.9	0.59	2, 3					
13.5	4	5.6	not weighed	2, 3					
14.0	7	9.9	0.81	3					
14.5	5	7.0	0.91	3, 4					
15.0	5	7.0	0.92	3, 4					
15.5	3	4.2	not weighed	4					
16.0	2	2.8	1.31	3, 4					
16.5	3	4.2	1.29	3, 4, 5					
17.0	3	4.2	1.44	3, 5					
17.5									
18.0									
18.5									

ELECTROFISHING CATCH	TOTAL CPUE = 45.0 /h YOY CPUE = 3.0 /h	GILL NET CATCH	5.2 /lift		

NUMBER, PERCENTAGE, WEIGHT, AND AGE OF Walleye (September 2009)									
TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AVERAGE WEIGHT (pounds)	AGE OF FISH	TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AVERAGE WEIGHT (pounds)	AGE OF FISH
1.0					19.0				
1.5					19.5	1	0.4	1.78	4
2.0					20.0				
2.5					20.5				
3.0					21.0	1	0.4	2.63	6
3.5					21.5				
4.0					22.0				
4.5					22.5				
5.0					23.0				
5.5	1	0.4	not weighed	YOY	23.5				
6.0	6	2.5	0.05	YOY	24.0				
6.5	25	10.5	0.08	YOY	24.5				
7.0	45	18.9	0.09	YOY	25.0				
7.5	56	23.5	0.11	YOY	25.5				
8.0	28	11.8	0.14	YOY	26.0				
8.5	8	3.4	0.17	YOY	TOTAL	238			
9.0	2	0.8	0.19	YOY					
9.5	1	0.4	not weighed	1					
10.0	2	0.8	0.28	1					
10.5	3	1.3	0.31	1					
11.0	3	1.3	0.33	1					
11.5	2	0.8	0.41	1					
12.0	3	1.3	0.46	1, 2					
12.5	5	2.1	0.52	1, 2					
13.0	5	2.1	0.58	2, 3					
13.5	9	3.8	0.66	2, 3					
14.0	6	2.5	0.76	2, 3					
14.5	12	5.0	0.86	3, 4					
15.0	4	1.7	0.89	3, 4					
15.5	4	1.7	1.00	4, 5					
16.0	1	0.4	1.01	4					
16.5									
17.0	3	1.3	1.33	5					
17.5	2	0.8	1.35	4					
18.0									
18.5									

ELECTROFISHING CATCH	TOTAL CPUE = 59.5 /h YOY CPUE = 42.8 /h				

AGE-LENGTH KEY FOR Walleye (September 2008)														
LENGTH GROUP (inches)	NUMBER COLLECTED	NUMBER AGED	AGE											
			1	2	3	4	5	6	7	8	9	10	11	12
1.0														
1.5														
2.0														
2.5														
3.0														
3.5														
4.0														
4.5	2													
5.0														
5.5	1													
6.0														
6.5														
7.0														
7.5														
8.0														
8.5	1	1	1											
9.0	5	5	5											
9.5	3	3	3											
10.0	4	4	3	1										
10.5														
11.0	2	2		2										
11.5	7	5		7										
12.0	4	4		4										
12.5	2	2			2									
13.0	7	5		4	3									
13.5	4	4		2	2									
14.0	7	5			7									
14.5	5	4			4	1								
15.0	5	5			2	3								
15.5	3	3				3								
16.0	2	2			1	1								
16.5	3	3			1	1	1							
17.0	3	3			2		1							
17.5														
18.0														
18.5														
19.0	1	1					1							
19.5														
20.0														
Total	71	61	12	20	24	9	3							
Mean TL			9.6	12.2	14.6	15.6	17.8							
SE			0.14	0.21	0.26	0.20	0.76							

AGE-LENGTH KEY FOR Walleye (September 2009)															
LENGTH GROUP (inches)	NUMBER COLLECTED	NUMBER AGED	AGE												
			0	1	2	3	4	5	6	7	8	9	10	11	12
4.0															
4.5															
5.0															
5.5	1	1	1												
6.0	6	5	6												
6.5	25	5	25												
7.0	45	5	45												
7.5	56	4	56												
8.0	28	5	28												
8.5	8	5	8												
9.0	2	2	2												
9.5	1	1		1											
10.0	2	2		2											
10.5	3	3		3											
11.0	3	3		3											
11.5	2	2		2											
12.0	3	3		2	1										
12.5	5	5		2	3										
13.0	5	5			3	2									
13.5	9	5			2	7									
14.0	6	5			1	5									
14.5	12	5				10	2								
15.0	4	4				2	2								
15.5	4	4					3	1							
16.0	1	1					1								
16.5															
17.0	3	3						3							
17.5	2	2					2								
18.0															
18.5															
19.0															
19.5	1	1					1								
20.0															
20.5															
21.0	1	1							1						
21.5															
22.0															
Total	238	87	171	15	10	26	11	4	1						
Mean TL			7.6	11.3	13.2	14.3	16.2	16.9	21.3						
SE			0.39	0.24	0.19	0.11	0.46	0.38	0						